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The disease of oats known as *Helminthosporium* blight is one of the most destructive of the diseases which have become established in the United States in recent years. Susceptible varieties, when attacked, are so severely injured that a crop is often a total loss. As far as is known, susceptibility is confined to one group of varieties, the Victoria hybrids. These varieties have been among the more promising ones recently released by the U.S. Department of Agriculture and have been widely planted.

Since 1945 when the disease was first observed in Iowa, it has spread through the oat growing areas wherever the Victoria hybrids have been grown. It was first found in Louisiana in January, 1947, in a field of oats planted with seed from Arkansas. Later in the same year severe infection was found in several other fields. Because of the severity of the disease in these fields and its potential possibilities, a warning was issued by C. W. Edgerton of the Louisiana Agricultural Experiment Station which included the recommendation that other varieties be substituted for the susceptible Victoria hybrids. This recommendation was generally followed, and the acreage planted in susceptible varieties in the fall of 1947 was much reduced. It has been estimated that this saved the growers in Louisiana as much as $100,000.

During the crop year of 1947-48, experimental work was carried on to determine the susceptibility of the varieties likely to be grown in Louisiana and to determine the value of seed treatment as a measure to reduce losses in susceptible varieties. A survey was also made to determine the distribution of the disease in Louisiana. This bulletin summarizes the information obtained and gives the symptoms of the disease and recommendations as to varieties to be grown in Louisiana.

Symptoms of Helminthosporium Blight

While oat plants are affected by *Helminthosporium* blight at all stages of growth, symptoms and injury are more easily recognized on the seedlings and on older plants at time of heading.

The leaves of infected seedlings show yellow to orange stripes along the margin (Figure 1*A*). As these leaves develop, they become brownish to orange and finally die. The young plants may continue to grow, or if severely diseased, will die, resulting in a seedling blight and poor stands. Roots of diseased seedlings are often discolored and rotten (Figure 2). Infected plants usually lack vigor and grow poorly.

When the seed are germinated in a petri dish, the seedlings of

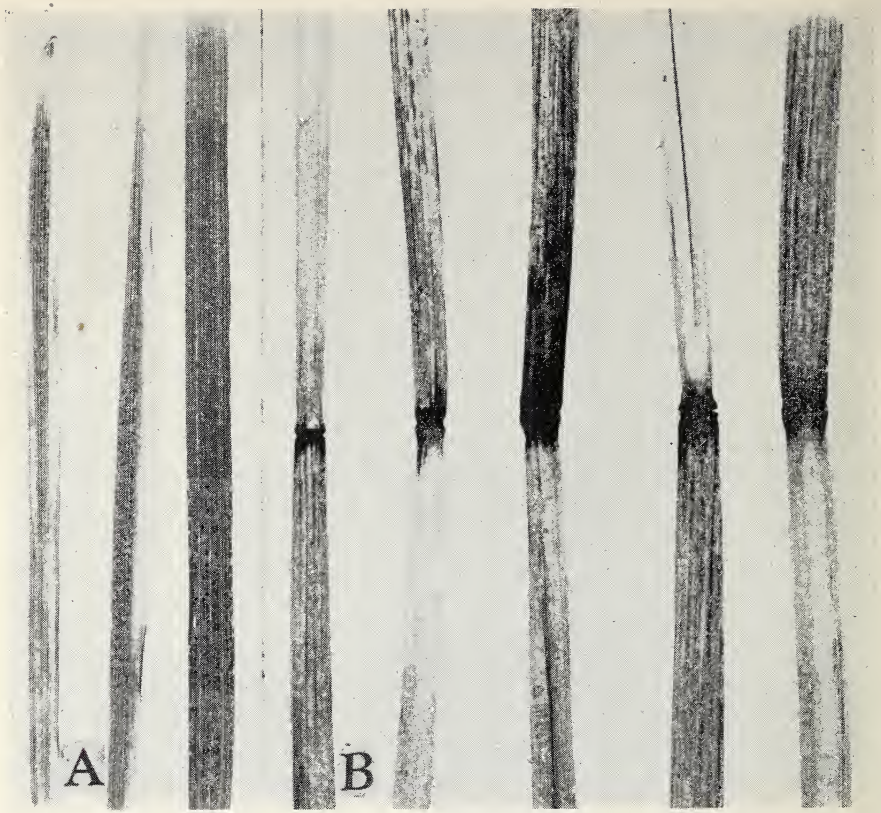

FIG. 1.—Symptoms of *Helminthosporium* blight of oats. *A*. Two leaves on left show striping in comparison with healthy leaf on right. *B*. Blackening of nodes of mature plants infected with the disease.

a susceptible variety deteriorate very rapidly. The susceptibility of a variety can usually be determined quickly by germinating the seed in this way (Figure 3).

When stooling begins, the diseased plants may be found singly or in small groups. As they reach the heading stage, there is a rotting of the crown and roots, accompanied by a browning of the lower internodes and a blackening of the nodes (Figure 1*B*). Infected plants are easily pulled up because of the poor root development. Considerable lodging may occur on account of bending or breaking of the stems. The blackening of the nodes is the most important symptom to use in the field of diagnosis of *Helminthosporium* blight. Later, at maturity, the grains also become black (Figure 4*A*).

It was noticed that at maturity, leaf spots often occurred which were distinct from the yellowish-orange striping of the leaves on seedlings. These were oval to elongate, and gray to brown. Typical

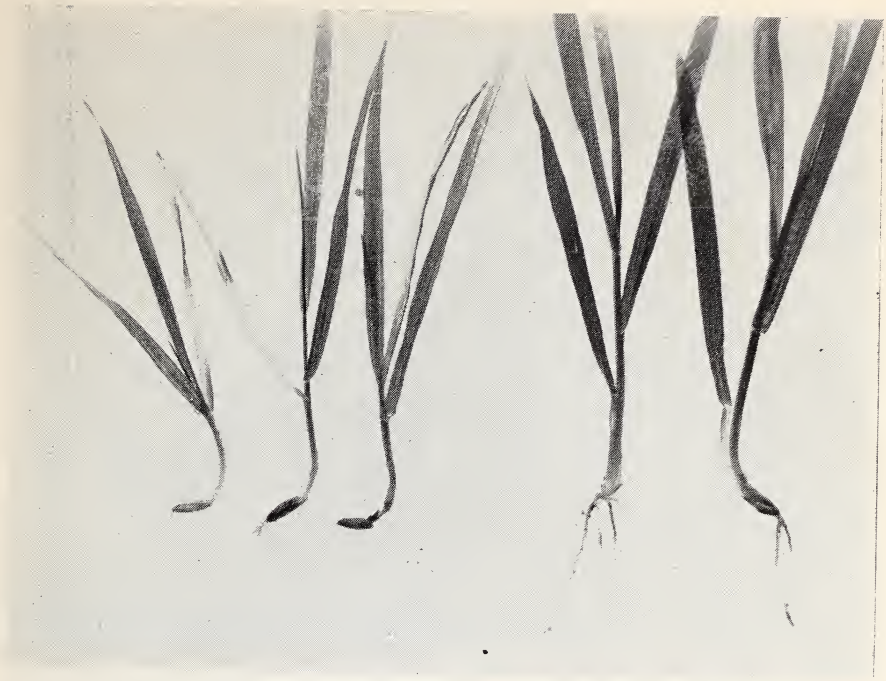

FIG. 2.—Root rot and dwarfing of oat seedlings infected with *Helminthosporium victoriae* (left) in comparison with healthy plants (right).

FIG. 3.—Reaction of a susceptible (Victorgrain) and a resistant variety (Nortex) to *Helminthosporium victoriae* in petri dishes.

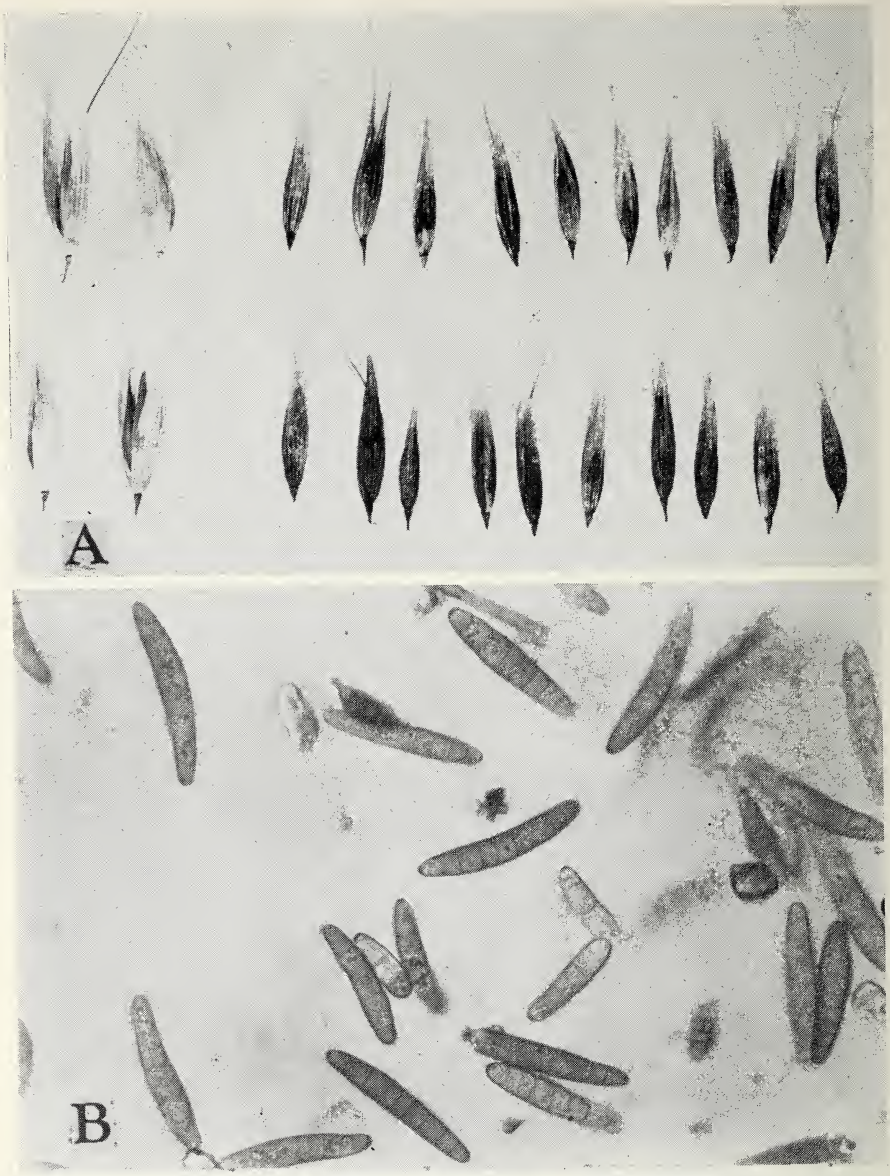

FIG. 4.—*A*. On right, oat seed of a susceptible variety blackened by *Helminthosporium victoriae*. Healthy seed of resistant variety on left. *B*. Spores of *Helminthosporium victoriae* (enlarged about 400 times).

spots varied in size up to 1/3 inch in length. The margins of the spots were usually distinct but were sometimes rather indefinite. The spots were larger on varieties with broad leaves, and when numerous often killed large areas of the leaves. Minute black bodies, the fruiting structures of the fungus, could be seen at times

in the center of the large spots. The leaves often bent or broke at the point of leaf spot infection when the spots were large and located on the lower half of the leaf.

Cause of Helminthosporium Blight

The disease is caused by the fungus *Helminthosporium victoriae*, which was first described by Meehan and Murphy in Iowa. The fungus is seed-borne, occurring on the glumes of the oat seed. It apparently can live over from one year to the next in the soil, since once a field is infested, the disease appears when the field is planted with disease free seed.

The blackened nodes characteristic of the disease are due to the presence of the spores and conidiophores of the fungus. The spread of the disease in the field from diseased to healthy plants and from one field to a neighboring one is by means of these spores (Figure 4*B*), which are carried by the wind.

FIG. 5.—Reaction of oat varieties to *Helminthosporium* blight. Upper picture (left to right): Traveler, Victorgrain, Fulghum, Clinton, and Camellia. Lower picture (left to right): Traveler, Victorgrain, Fulgrain, Camellia, and Nortex.

Varietal Reaction

The oat varieties available at the present time for planting in Louisiana belong to three groups: Victoria hybrids, Bond hybrids, and Red Rustproof selections. The Victoria hybrids have been of particular value, since they have been very resistant to crown rust and stem rust, two diseases of considerable importance in Louisiana. They have as one of the original parents, the variety Victoria, and the resistance to the two rusts comes from this parent. The Bond hybrids are selections from crosses in which the variety Bond was used as one parent. Some of these varieties, of which Camellia is an example, are resistant to most races of crown rust but are susceptible to stem rust. The Red Rustproof selections are not as resistant to crown rust as the varieties belonging to the other two groups.

In order to have definite information on the resistance of the varieties likely to be grown in Louisiana to *Helminthosporium* blight, a number of greenhouse tests and one field test were made in the crop season of 1947-48.

In the greenhouse tests, the procedure used was the following. Pure cultures of the fungus from Iowa, New York and Louisiana were grown on sterilized oats until there was good growth and many spores. A suspension of spores and mycelium in water was made with a Waring blendor, and this was diluted 1 part to 9 of water. This was sprinkled over the seed and soil at planting and again as the seedlings emerged. The plants were grown in six-inch pots filled with Lintonia soil to which a small amount of fertilizer had been added. In the tests, 5 pots with 25 seeds to each pot were used for each variety. Two disease readings were made at 10-day intervals after the disease symptoms appeared. The temperature of the greenhouse was kept at approximately 72°F. The reaction of some of the varieties tested is shown in Figure 5.

The results of two greenhouse tests are given in Table 1. This table includes 23 varieties, one unnamed selection, and three seed lots of one variety, Victorgrain. The percentage of plants infected ranged from 0 to nearly 90, depending on the variety.

All of the eleven Victoria hybrids shown in the table were very susceptible. These included DeSoto, Fulgrain, Fultex, Lega, Letoria, Quincy Red, Ranger, Stanton, Traveler, Vicland and Victorgrain. The three Bond hybrid varieties and one unnamed selection, Benton, Camellia, Clinton and Louisiana 42-48, were all resistant. Eight of the nine Red Rustproof varieties were very resistant. These were Alber, Appler, Ferguson 922, Fulghum, Hasting's 100 Bu., Louisiana Red Rustproof, Lee, New Nortex and Nortex 107. Fulghum was intermediate. This erratic reaction of Fulghum also has been found in other areas.

TABLE 1. Reaction of Oat Varieties to *Helminthosporium Victoriae* in Greenhouse Tests in 1947-48

Variety	Per Cent Infected Plants		
	Test 1	Test 2	Average
Victoria Hybrids			
DeSoto	57.4	44.2	50.8
Fulgrain	43.2	23.3	33.3
Fultex	56.2	59.3	57.8
Lega	48.7	88.6	68.7
Letoria	39.4	55.4	47.4
Quincy Red	48.0	38.7	43.4
Ranger	17.6	50.4	34.0
Stanton	45.7	38.2	42.0
Traveler	65.5	54.5	60.0
Vicland	45.2	57.3	51.3
Victorgrain (Lot 1)	49.6	78.7	64.2
Victorgrain (Lot 2)	69.2	65.0	67.1
Victorgrain (Lot 3)	56.8	79.2	68.0
Bond Hybrids			
Benton	0.9	8.5	4.7
Camellia	0.0	5.9	3.0
Clinton	0.0	4.6	2.3
La. 42-48*	5.6	20.7	13.2
Red Rustproof Varieties			
Alber	0.0	4.7	2.4
Appler	0.8	0.9	0.9
Ferguson 922	0.8	0.0	0.4
Fulghum	32.8	27.9	30.4
Hasting's 100 Bu.	0.0	1.8	0.9
La. Red Rustproof	3.2	0.0	1.6
Lee	7.1	4.5	5.8
New Nortex	0.0	3.3	1.7
Nortex 107	0.0	0.0	0.0

*A promising selection similar to Camellia which has not yet been released.

In addition to the named varieties of oats given in Table 1, a number of selections were also tested in the greenhouse. These were provided by the Coker's Pedigreed Seed Company and the Crops and Soils Department of the Louisiana Agricultural Experiment Station. Data for a few of these unnamed selections are given in Table 2 to illustrate the necessity of testing promising selections before they are released as named varieties or before they are used in extensive yield tests.

TABLE 2. Results of Inoculation Tests with Unnamed Selections of Oats for Resistance to *Helminthosporium* Blight

Selection Number	Source	Per Cent Infection		
		Test 1	Test 2	Average
Coker 47-77	Coker's Seed Co.	0.0	0.0	0.0
Coker 47-78	Coker's Seed Co.	0.0	0.0	0.0
Coker 47-51	Coker's Seed Co.	67.0	68.3	67.7
Coker 47-52	Coker's Seed Co.	43.1	75.0	59.1
II-49	Crops and Soils, L. S. U.	0.0	0.0	0.0
II-50	Crops and Soils, L. S. U.	0.0	0.0	0.0
II-16	Crops and Soils, L. S. U.	75.6	75.4	75.5
II-20	Crops and Soils, L. S. U.	73.4	79.2	76.3

One field test was made in the fall of 1947. Seeds of the twelve varieties used were sprayed with a spore suspension of *Helminthosporium victoriae* and dried. They were planted on November 6, and disease readings were made December 16.

The tests, Table 3, while showing less diseased plants than the greenhouse tests, gave essentially the same results. The four Victoria hybrids, Letoria, Quincy Red, Traveler and Victorgrain, were susceptible; the three Bond hybrids, Camellia, Clinton and Louisiana 42-48, and of the five Red Rustproof varieties, Alber, Ferguson 922, Fulghum, and Nortex 107 were resistant. Appler was intermediate in this test, but symptoms were much less severe.

TABLE 3. Reaction of 12 Oat Varieties to *Helminthosporium victoriae* in Field Test in 1947-48

Victoria Hybrids		Bond Hybrids		Red Rustproof	
Variety	% Infected Plants	Variety	% Infected Plants	Variety	% Infected Plants
Letoria	27.7	Camellia	9.2	Alber	5.3
Quincy Red	32.7	Clinton	3.2	Appler	17.3
Traveler	26.0	La. 42-48	4.0	Ferguson 922	4.3
Victorgrain	35.5			Fulghum	2.3
				Nortex 107	1.8

Occurrence of Helminthosporium Blight in Louisiana in 1948

A survey was made to determine the damage caused by *Helminthosporium victoriae* in Louisiana in the 1947-48 oat crop. The oat-growing sections of Louisiana, including Northeastern, Northwestern, Central, and Southern, were visited in the survey.

Most of the oats planted in these sections were either Bond or Red Rustproof varieties. In former years before the *Helminthosporium* blight became a factor, the plantings of the Victoria hybrids, Fulgrain, Fultex, Victorgrain, Traveler, and other early maturing varieties had been unusually large. Camellia oats were planted almost exclusively in the Baton Rouge area.

Results shown in Table 4 indicate the amount of the disease and its severity on the Victoria hybrids. It was impossible to be certain as to the identity of varieties in some fields grown for feed and pasture. The seed used was evidently not pure and mixtures were present in many fields.

TABLE 4. Survey to Determine the Occurrence of *Helminthosporium* Blight in Louisiana in 1948, Based on Leaf and Culm Symptoms

Variety	Maturity	Acreage	Leaves	Culms	Location
Victoria Hybrid*	Late Dough	30	5†	5†	Tensas
Victoria Hybrid	Late Dough	30	5	1	Madison
Victoria Hybrid	Late Dough	12	5	3	Madison
Mixed Victoria Hybrid	Late Dough	25	5	1	Franklin
Mixed Victoria Hybrid	Late Dough	35	5	0	Franklin
Victorgrain	Late Dough	25	5	1	Franklin
Victorgrain	Dough	40	5	2	Catahoula
Victorgrain	Late Dough	40	5	1	Franklin
Victorgrain	Late Dough	27	5	2	Catahoula
Victorgrain	Late Dough	60	5	5	Caddo
Victorgrain	Late Dough	20	5	2	Caddo
Victorgrain	Late Dough	50	Complete	Loss	Caddo
Victorgrain	Late Dough	100	5	3	Bossier
Victoria Hybrid	Late Dough	45	5	2	Bossier
Fulghum	Late Dough	100	3	0	Caddo
Mixed Victoria	Late Dough	60	5	1	Caddo
Victoria Hybrid	Late Dough	40	5	2	Ouachita
Victoria Hybrid	Late Dough	100	5	1	Ouachita
Letoria	Late Dough	55	5	1	Ouachita
Victoria Hybrid	Late Dough	30	5	1	Morehouse
Fulgrain	Late Dough	80	5	2	Ouachita
Traveler	Dough	25	4	0	Ouachita
Victoria Hybrid	Late Dough	18	5	2	Ouachita
Camellia	Various	3000	0	0	Baton Rouge
Nortex	Milk	600	0	0	Ouachita

*Victoria hybrid: Name of variety not known.

†Key to symbols indicating severity of disease on leaves and culms: 1–Trace; 2–Disease easily found; 3–Prevalent; 4–Prevalent and culms breaking at nodes; 5–Disease severe.

There was very little difference in the degree of infection on the leaves, although there was some difference in degree of infection on the culms. Some fields of Victoria hybrids were so severely damaged they were not harvested.

As indicated in Table 4, *Helminthosporium* blight was not found on any of the Red Rustproof or Bond varieties in the field except Fulghum. On Fulghum the disease was found on the leaves and not on the culms.

Seed Treatment

As seed treatment with New Improved Ceresan has been recommended in other areas for varieties susceptible to *Helminthosporium* blight, tests were made to determine if such treatment would have value under Louisiana conditions. Two fungicides, New Improved Ceresan and Dow 9B, were used in tests at Baton Rouge and at the Northeast Louisiana Agricultural Experiment Station, St. Joseph. Victorgrain and Camellia were the varieties used. The seed were treated one week before planting for the test at Baton Rouge and five weeks before planting for the one at St. Joseph. The chemicals were shaken with the seed and the excess screened off. More of the chemicals than is generally recommended were used. Five replications, each consisting of 20 feet of row with the same number of seed, were used for each variety at each place.

The results, given in Table 5, show that New Improved Ceresan was very toxic. Dow 9B gave no increases in stand. No differences in the amount of *Helminthosporium* blight were noted.

TABLE 5. Results of Seed Treatment Tests with Two Oat Varieties at Baton Rouge and St. Joseph, Louisiana, in the Fall of 1947

Variety	Baton Rouge			St. Joseph		
	No Treatment	New Improved Ceresan	Dow 9B	No Treatment	New Improved Ceresan	Dow 9B
	Per Cent Emergence					
Victorgrain	73.8	11.1	80.8	75.0	0.1	69.1
Camellia	87.5	42.3	95.0	88.5	25.7	89.7

Another test was made at Baton Rouge with six chemicals. Only the variety Victorgrain was used. The percentage emergence is given in Table 6. Both the New Improved Ceresan and Ceresan M were toxic. None of the chemicals increased stands or reduced *Helminthosporium* blight.

One other test was made in the greenhouse in soil infested with *Helminthosporium victoriae* and in clean soil. New Improved Ceresan at ½ oz., 1 oz., and 1½ oz. to the bushel was used with naturally infected seed of the oat variety Victorgrain. The results (Table 7) indicate seed treatment was of little value in increasing stands or reducing the number of infected seedlings.

During the season, several fields were examined which had been planted with seed treated with New Improved Ceresan. There was as much disease present as in fields planted with untreated seed.

The results of the tests did indicate that an excessive amount of Ceresan should not be used, not over ½ to 1 oz. to the bushel.

TABLE 6. Results of Seed Treatment Tests with Six Fungicides on Victorgrain Oats

Treatment	Average Number Plants Emerged*	Percentage Emergence
Ceresan M	21	10.5
N. I. Ceresan	2	1.0
Phygon	127	63.5
Spergon	132	66.0
Dow 9B	145	72.5
Arasan	156	78.0
Untreated	150	75.0

*Average of five replications, 200 seed per replication. Planted November 25, 1947. Stand counts made December 16, 1947.

TABLE 7. Effect of Different Rates of New Improved Ceresan on Naturally Infected Victorgrain Oats in Greenhouse Test

Rate Per Bushel	Infested Soil		Non-Infested Soil	
	Percentage Emergence	Percentage Infection	Percentage Emergence	Percentage Infection
½ Ounce + Talc	97.6	75.2	97.6	44.3
½ Ounce	94.5	59.3	87.2	20.1
1 Ounce	91.2	67.5	87.2	31.1
1½ Ounces	71.2	73.0	79.2	11.1
Untreated	84.8	82.1	87.2	16.6

Discussion

The results of the tests to determine susceptibility of the varieties of oats to *Helminthosporium victoriae* indicate that none of the Victoria hybrids which have been released are safe for planting in Louisiana. This means that the varieties to be grown in Louisiana, for the present at least, will of necessity be those from Bond crosses and Red Rustproof types. While the shift from the Victoria hybrids to these other varieties will eliminate losses due to *Helminthosporium* blight, it is an unfortunate change, since losses from crown rust and stem rust may occur, particularly in years which are favorable for the development of rust epidemics.

It is hoped that new varieties will eventually be produced that will have the rust resistance that made the Victoria hybrids so valuable, as well as the resistance to the *Helminthosporium* blight.

Summary

The *Helminthosporium* blight of oats caused by *Helminthosporium victoriae* is described in this bulletin.

The resistance and susceptibility of 24 oat varieties has been determined.

Varieties selected from crosses in which Victoria was one parent were susceptible to the disease. Varieties selected from crosses in which Bond and not Victoria was one parent or from the Red Rustproof group were resistant. On account of the severe loss caused by the *Helminthosporium* blight, it apparently will not be possible to grow susceptible Victoria hybrids in Louisiana.

Seed treatment tests showed little or no promise in controlling the disease with susceptible varieties.

Recommendations

1. The Victoria hybrids, such as Victorgrain, Traveler, Fulgrain and Letoria, are so susceptible to *Helminthosporium* blight that they should not be planted in Louisiana. Seed treatments have not prevented losses and at present are not being recommended.
2. The Camellia variety is resistant and is recommended for further planting in certain sections of the state, particularly in the Southern and Central sections.
3. In the Northern part of the state, growers should at present select their varieties for planting from among the Red Rustproof group, such as New Nortex, Nortex 107, and Hasting's 100 Bushel.
4. New varieties that come out in the future should be tested by the Louisiana Agricultural Experiment Station for resistance to *Helminthosporium* blight and should not be planted on a large scale by growers before being recommended by the station.